JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

August 10, 2004

TO: E. Burke

FROM: S. Guduru

SUBJECT: Mars Global Surveyor Extended Mission

The Resource Allocation Planning and Scheduling Office (RAPSO) performed a loading study to determine the impacts of Mars Global Surveyor (MGS) extended mission tracking requirements on the Deep Space Network (DSN) and the ability to support those requests.

Summary

Overall Mars Global Surveyor is expected to receive 75 to 80% of the requested time for the duration of the extended mission. There is no significant impact in 2007. In 2006, it is important to note that the supportable time for MGS would increase from an average of 75% to 87% if it agrees to multiple spacecraft per antenna (MSPA) with MRO during the Aerobraking phase. However in 2005 and 2008, there are periods (March 2005 and 2008) when supportable time declines below 70% and in (December 2005, April 2008 and July 2008) when supportable time declines below 60%. The contention during these periods can be reduced with increased use of MSPA support with other MARS missions like Mars Express Orbiter (MEX), Mars Odyssey (M01O) and Mars Reconnaissance Orbiter (MRO) on the 34-meter subnet and by offloading some support from the 34-meter to the 70-meter and agreeing to MSPA nearly 100% with MEX and M01O on the 70-meter subnet.

Analysis was accomplished using the FASTER (Forecasting And Scheduling Tool for Earth-based Resources) forecasting system, the Mars 6-degree-mask view period, and the updated mission set database from the August 2004 Pre Resource Allocation Review Board (RARB).

Requirements

Mars Global Surveyor extended mission requirements begin on October 1, 2004 and continue until October 31, 2008. This study focuses on the period starting from January 1, 2005 through October 31, 2008 because the RAPSO mid-range schedule has already being negotiated through the end of year 2004. It addresses Mars Global Surveyor's extended mission requirements keeping in place the agreements to do MSPA support with Mars Express Orbiter (MEX) and Mars Odyssey (M01O) as a result of previous RARB negotiations and agreements.

See the attached User Loading Profile for weekly requirements, MSPA usage, and resource distribution at the end of the study.

The updated requirements for the extended mission are as below:

Beta-supplement HGA Ops October 1, 2004 – December 14, 2005

16 hours/day + 2 hours spread over 2 days

Nominal HGA Ops December 15, 2005 – March 16, 2006 (MRO MOI)

14 hours/day

MRO MOI – End of Aero braking March 17, 2006 – September 13, 2006

24 hours continuous downlink

Beta-supplement HGA Ops September 14, 2006 – February 28, 2008

14 hours/day + 2 hours spread over 2 days

Nominal HGA Ops March 01, 2008 – October 31, 2008 (EOEM)

14 hours/day

Figure 1

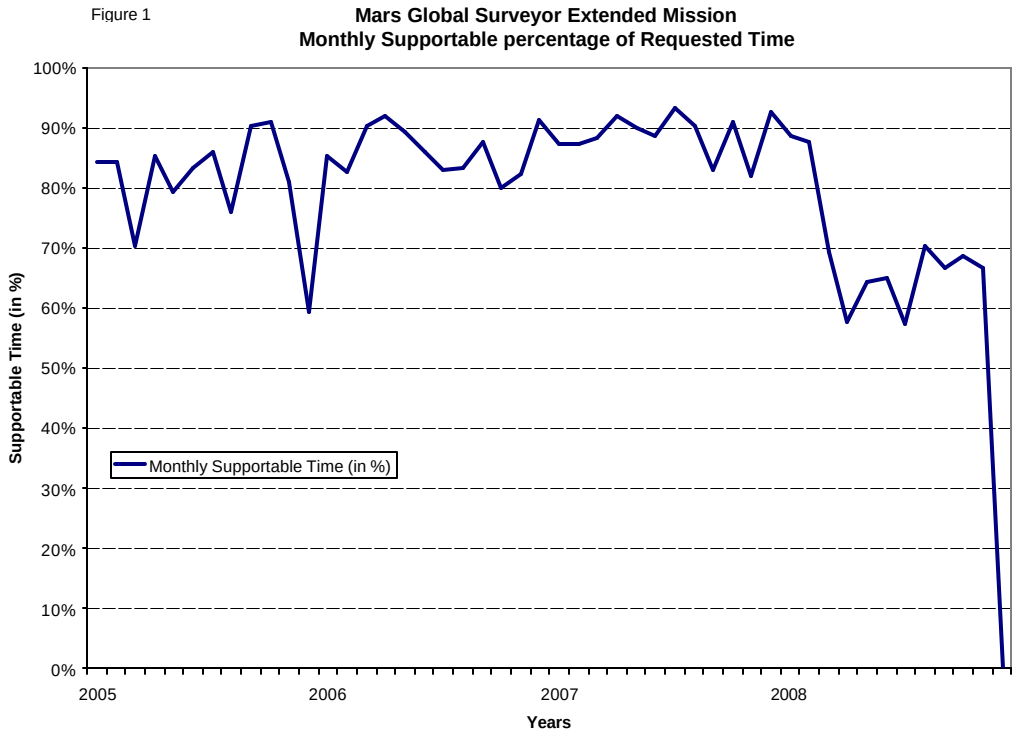


Figure 1 shows the forecast monthly supportable percentage of requested time for the duration of the study interval. MGS should expect to receive 75 to 80% of the time

requested except in March 2005 and 2008, when supportable time declines below 70% and in December 2005, April 2008 and July 2008 when supportable time declines below 60%. These periods are further analyzed and discussed as below.

MGS has contention with several users at 34-meter due to viewperiods overlap among various missions.

In March 2005, it has contention with requirements supporting Deep Impact Flyby (DIF) TCM, Deep Space Station (DSS) maintenance, Messenger (MSGR) cruise, Rosetta (ROSE) Earth swingby, Stardust (SDU) TCM, SOHO keyhole and routine support for Ulysses (ULYS), Voyager 1 (VGR1) and WIND respectively. MGS has 70% viewperiod overlap with MSGR, 40-60% overlap with DIF, 50-100% overlap with DSS Maintenance, 70% overlap with SDU, 50% overlap with SOHO, 40% overlap with ULYS at Canberra, 80% overlap with VGR1 and 60-90% overlap with WIND.

In December 2005, MGS has contention with requirements supporting MRO cruise, SDU TCM, Voyager 2 (VGR2) MAGROL and routine support. MGS has 100% overlap with MRO and SDU and 80% overlap with VGR2 at Canberra. MGS has to offload some support to the 70-meter and do nearly 100% MSPA with MEX and M01O at the 70M to reduce contention at 34–meter.

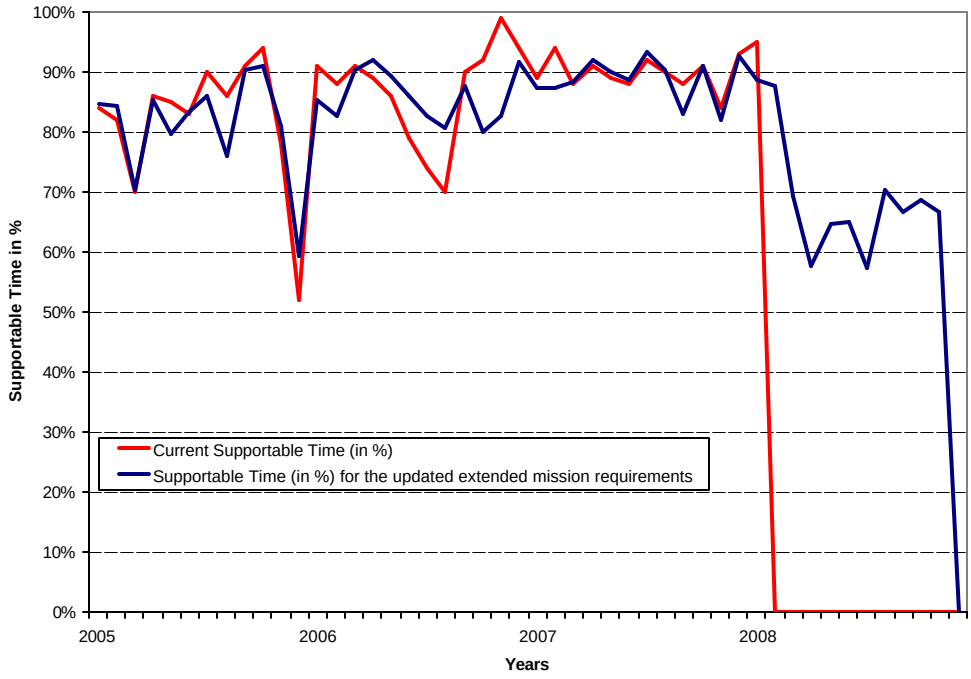
In April 2008, MGS has contention with several users on the 34-meter. It has contention with DSS maintenance, Keppler (KEPL) Science Ops, MEX orbital science, MSGR Cruise, MRO prime science, Phoenix (PHX) approach and TCM and Stereo Behind (STB) prime science. MGS has 50% overlap with DSS maintenance, 95% overlap with KEPL, 80% overlap with MSGR, 100% with MEX, MRO and PHX and about 85% overlap with STB. MGS has to increase MSPA support with M01O and MEX on the 70M and MRO and MEX on the 34-meter to reduce contention since PHX is in its approach phase and cannot do MSPA during this time.

In the month of July 2008, MGS has contention with several users on the 34-meter. It has contention with requirements supporting Cassini (CAS) tour, DSS maintenance, KEPL Science Operations, M01O relay for PHX, MEX Orbital Science, MRO Prime Science and Ops Ka demo, MSGR Cruise and PHX Relay and Surface Operations. MGS has 100% overlap with CAS, 60% overlap with DSS maintenance, 75% overlap with KEPL, 70% overlap with MSGR, 100% overlap with M01O, MEX, MRO and PHX. MGS must MSPA to the maximum extent with other Mars missions on the 34-meter and with MRO on the 70-meter to reduce contention during this period.

In addition to the periods discussed above, MGS's supportability is also further decreased by the requirements supporting 24-hour simultaneous coverage for Reference Frame Calibration (RFC) CAT X\Ka events on the 34-meter subnet and Space Geodesy's (SGP) requirement of 24-hour supports for crustal dynamics events on the 34HEF.

Figure 2 compares the current forecasted monthly supportable percentage of requested time to that of the updated extended mission requirements received for MGS.

Figure 2 **MGS Current Supportability Vs Extended Mission Supportability**



It is important to note that supportable time for MGS would increase from an average of 75% to 87% if it is allowed to MSPA with MRO during the Aerobraking phase. This study considers that MGS will MSPA nearly 100% with MRO during this period.

Figure 3 **MGS Supportability during MRO Aerobraking Phase**

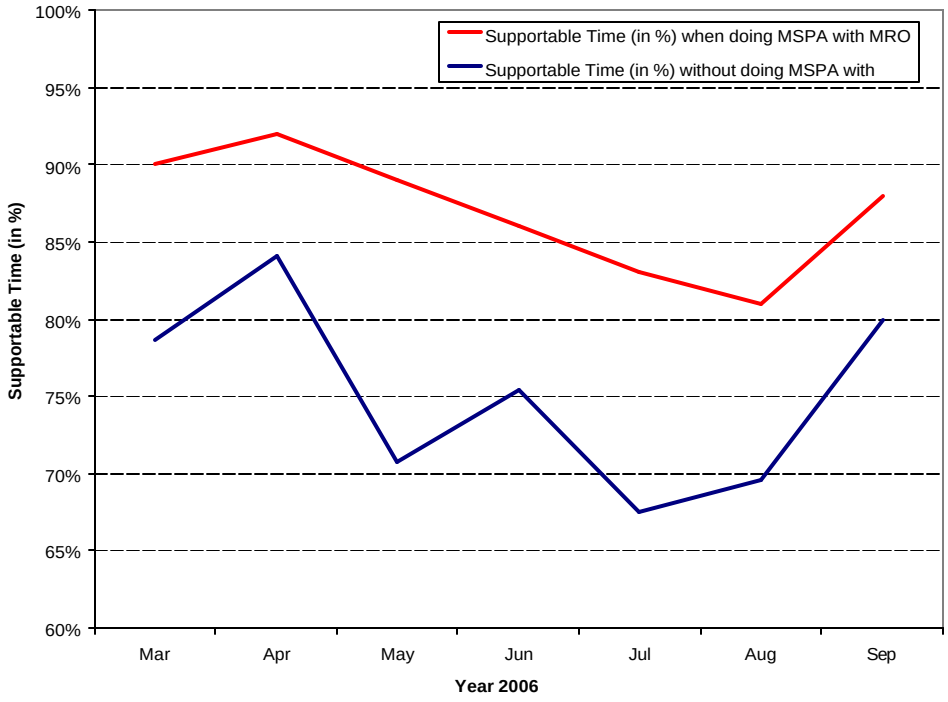


Figure 3 compares the forecasted monthly supportable percentage of requested time for the Aerobraking phase when MGS does MSPA with MRO to when it does not.

In conclusion, MGS should receive 75% to 80% of the requested time for the duration of the extended mission. However in 2005 and 2008, there are periods (March 2005 and 2008) when supportable time declines below 70% and in (December 2005, April 2008 and July 2008) when supportable time declines below 60%. There is no significant impact in 2007. During the Aerobraking phase in 2006, the supportable time for MGS would increase from 75% to 87% if it is allowed to MSPA with MRO. The contention during these periods of high activity can be reduced with careful scheduling and increased use of MSPA support with other MARS missions like Mars Express Orbiter (MEX), Mars Odyssey (M01O) and Mars Reconnaissance Orbiter (MRO) on the 34-meter subnet and by offloading some support from the 34-meter to the 70-meter and agreeing to MSPA nearly 100% with MEX and M01O on the 70-meter subnet.

As always, the results of this study are preliminary in that network loading changes as requirements for planned missions are input and updated. We will continue to work with Mars Global Surveyor and other users of the DSN to maximize the time available for each individual user.

cc:
A. Andujo
R. Bartoo
E. Hampton
N. Lacey
D. Morris
J. Retana
O.Gordon

30-Jul-04

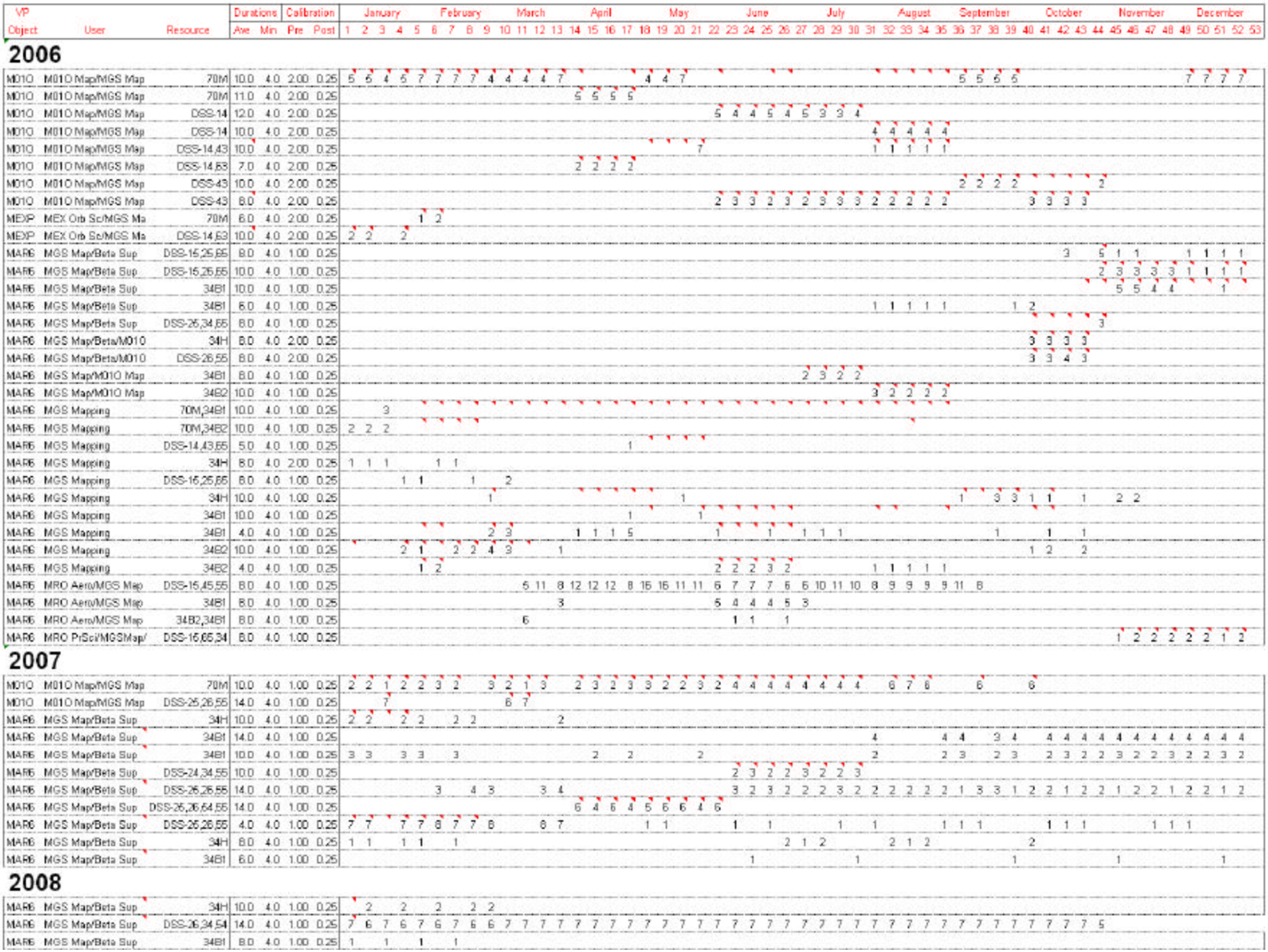
User Loading Profiles

Concurrence:

Project Manager Date

MGS

VP Object	User	Resource	Durations Ave	Min	Calibration Pre	Post	January 1 2 3 4 5	February 6 7 8 9	March 10 11 12 13 14	April 15 16 17 18 19	May 20 21 22 23 24	June 25 26 27 28 29	July 30 31 32 33 34	August 35 36 37 38 39	September 40 41 42 43 44	October 45 46 47 48 49	November 50 51 52 53	December
2005																		
M01O	M01O Map/MGS Map	70M	10.0	4.0	2.00	0.25		2 5										
M01O	M01O Map/MGS Map	DSS-14	7.0	4.0	2.00	0.25												
M01O	M01O Map/MGS Map	DSS-63	8.0	4.0	2.00	0.25								3 3 3 3	2	7		
M01O	M01O Map/MGS Map	DSS-43	13.0	4.0	2.00	0.25	1 1 4 4											
M01O	M01O Map/MGS Map	DSS-43	10.0	4.0	2.00	0.25	3 3 3 2 2 3	3		4								
M01O	M01O Map/MGS Map	DSS-63	10.0	4.0	2.00	0.25											7 7 7 7 7	
MAR6	MGS Map/Beta Sup	34H	14.0	4.0	1.00	0.25						7 6		4 4 4		4 7		
MAR6	MGS Map/Beta Sup	DSS-15,45	10.0	4.0	1.00	0.25		7 7 7										
MAR6	MGS Map/Beta Sup	DSS-15,45,54	14.0	4.0	1.00	0.25				3								
MAR6	MGS Map/Beta Sup	DSS-15,45,55	14.0	4.0	1.00	0.25		2	6		5 5 6 6 7 6 7 6							
MAR6	MGS Map/Beta Sup	DSS-15,45,63	14.0	4.0	1.00	0.25		7 6										
MAR6	MGS Map/Beta Sup	34H	12.0	4.0	1.00	0.25									7 7 5 7			
MAR6	MGS Map/Beta/M01O	34H	14.0	4.0	1.00	0.25							7 6 7 5 4 4		1 1 1		1	
MAR6	MGS Map/Beta/M01O	DSS-16,45,55	10.0	4.0	1.00	0.25				6 4 6 4								
MAR6	MGS Mapping	DSS-15,45	8.0	4.0	1.00	0.25		2	2 2	1 1 2		2 2	1	2 1 1 1 2		1	6 3 2 2	
M01O	M01O Map/MGS Map	DSS-24,45,54	10.0	4.0	2.00	0.25		2 2										
MAR6	MGS Map/Beta Sup	34B1	10.0	4.0	1.00	0.25			2 2 1			2 2 3 2		2 2 3 2 2 3 2		2 2		
MAR6	MGS Map/Beta Sup	DSS-24,34,55	10.0	4.0	1.00	0.25			3									
MAR6	MGS Map/Beta Sup	DSS-24,34,65	14.0	4.0	1.00	0.25	3 3 1 2					2						
MAR6	MGS Map/Beta Sup	DSS-24,45,54	10.0	4.0	1.00	0.25		4			2 2 2							
MAR6	MGS Map/Beta Sup	DSS-34	9.4	4.0	1.00	0.25								2				
MAR6	MGS Map/Beta Sup	DSS-24,45,54	10.0	4.0	1.00	0.25	1											
M01O	M01O Map/MGS Map	DSS-25,65	10.0	4.0	2.00	0.26	2 2 3 2											
M01O	M01O Map/MGS Map	DSS-25,26	12.0	4.0	2.00	0.25								4 4				
M01O	M01O Map/MGS Map	34B2	10.0	4.0	2.00	0.25			2 3 2									
MAR6	MGS Map/Beta Sup	34B2	14.0	4.0	1.00	0.25		2						3 3		7 7		
MAR6	MGS Map/Beta Sup	DSS-25,34,55	10.0	4.0	1.00	0.25				4							3	
MAR6	MGS Map/Beta Sup	DSS-26,34,65	4.0	4.0	1.00	0.25	3 3 1											
MAR6	MGS Map/Beta Sup	DSS-26,45,55	14.0	4.0	1.00	0.25			7 6 7	7 6								
MAR6	MGS Map/Beta Sup	DSS-26,45,55	10.0	4.0	1.00	0.25						3 2		2 2		1 2		
MAR6	MGS Map/Beta Sup	34B2	4.0	4.0	1.00	0.25	1 1	3		4 5				3 3			3 3	
MAR6	MGS Map/Beta Sup	34B2	6.0	4.0	1.00	0.25	1 1		1 1			1	1	1 1	2			
MAR6	MGS Map/Beta/M01O	34B2	14.0	4.0	1.00	0.25								3 3 3				


VP
Object
User
Resource
Durations
Ave Min
Calibration
Pre Post
January
February
March
April
May
June
July
August
September
October
November
December
2006
M01O M01O Map/MGS Map 70M 10.0 4.0 2.00 0.25
M01O M01O Map/MGS Map 70M 11.0 4.0 2.00 0.25
M01O M01O Map/MGS Map DSS-14 12.0 4.0 2.00 0.25
M01O M01O Map/MGS Map DSS-14 10.0 4.0 2.00 0.25
M01O M01O Map/MGS Map DSS-14,43 10.0 4.0 2.00 0.25
M01O M01O Map/MGS Map DSS-14,63 7.0 4.0 2.00 0.25
M01O M01O Map/MGS Map DSS-43 10.0 4.0 2.00 0.25
M01O M01O Map/MGS Map DSS-43 8.0 4.0 2.00 0.25
MEXP MEX Orb Sc/MGS Ma 70M 6.0 4.0 2.00 0.25
MEXP MEX Orb Sc/MGS Ma DSS-14,63 10.0 4.0 2.00 0.25
MAR6 MGS Map/Beta Sup DSS-15,25,65 8.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-15,25,65 10.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34B1 10.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34B1 6.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-26,34,65 8.0 4.0 1.00 0.25
MAR6 MGS Map/Beta/M01O 34H 8.0 4.0 2.00 0.25
MAR6 MGS Map/Beta/M01O DSS-26,55 8.0 4.0 2.00 0.25
MAR6 MGS Map/M01O Map 34B1 8.0 4.0 1.00 0.25
MAR6 MGS Map/M01O Map 34B2 10.0 4.0 1.00 0.25
MAR6 MGS Mapping 70M,34B1 10.0 4.0 1.00 0.25
MAR6 MGS Mapping 70M,34B2 10.0 4.0 1.00 0.25
MAR6 MGS Mapping DSS-14,43,65 5.0 4.0 1.00 0.25
MAR6 MGS Mapping 34H 8.0 4.0 2.00 0.25
MAR6 MGS Mapping DSS-16,25,65 8.0 4.0 1.00 0.25
MAR6 MGS Mapping 34H 10.0 4.0 1.00 0.25
MAR6 MGS Mapping 34B1 10.0 4.0 1.00 0.25
MAR6 MGS Mapping 34B1 4.0 4.0 1.00 0.25
MAR6 MGS Mapping 34B2 10.0 4.0 1.00 0.25
MAR6 MGS Mapping 34B2 4.0 4.0 1.00 0.25
MAR6 MRO Aero/MGS Map DSS-15,45,55 8.0 4.0 1.00 0.25
MAR6 MRO Aero/MGS Map 34B1 8.0 4.0 1.00 0.25
MAR6 MRO Aero/MGS Map 34B2,34B1 8.0 4.0 1.00 0.25
MAR6 MRO PrSci/MGSMap/ DSS-16,65,34 8.0 4.0 1.00 0.25
2007
M01O M01O Map/MGS Map 70M 10.0 4.0 1.00 0.25
M01O M01O Map/MGS Map DSS-25,26,55 14.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34H 10.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34B1 14.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34B1 10.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-24,34,55 10.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-26,26,55 14.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-26,26,64,55 14.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-26,26,55 4.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34H 8.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34B1 6.0 4.0 1.00 0.25
2008
MAR6 MGS Map/Beta Sup 34H 10.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup DSS-26,34,54 14.0 4.0 1.00 0.25
MAR6 MGS Map/Beta Sup 34B1 8.0 4.0 1.00 0.25